Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Revision of Part 15 of the Commission's Rules	)	
Regarding Ultra-Wideband Transmission	)	
Systems	)	ET Docket 98-153
	)	
To: The Commission	)	

SUPPLEMENTAL COMMENTS OF ROCKWELL COLLINS, INC. REGARDING NTIA'S UWB ANALYSES REPORTS

Rockwell Collins, Inc. ("Rockwell Collins") a subsidiary of Rockwell International Corporation, hereby submits these supplemental electronic comments in response to the two National Telecommunications and Information Administration ("NTIA") reports analyzing the potential for ultra-wideband ("UWB") transmissions systems to cause harmful interference to U.S. Government radio operations between 400 MHz and 6000 MHz of the radio spectrum.[1]

INTRODUCTION

Rockwell Collins is a major manufacturer and integrator of avionics and Global Positioning System (GPS) equipment and systems for civilian and military markets. In addition to GPS equipment, Rockwell Collins manufactures a complete series of civilian and military aeronautical radio communications, navigation, and surveillance equipment, including Microwave Landing System (MLS) receivers. Rockwell Collins provided comments and reply

[1] Lawrence K. Brunson, *et al.*, Assessment of Compatibility Between Ultra-Wideband Devices and Selected Federal Systems, NTIA Special Publication 01-43 (Jan. 2001) (filed, ET Docket No. 98-153, Jan. 18, 2001) ("OSM Report"); William Kissick, *ed.*, The Temporal and Spectral Characteristics of Ultra-Wideband Signals, NTIA Report 01-383 (Jan. 2001) (filed, ET Docket No. 98-153, Jan. 18, 2001) ("ITS Report"); *see* Public Notice, *Comments Requested on Test Data Submitted by the National Telecommunications and Information Administration Regarding Potential Interference from Ultra-Wideband Transmission Systems* (ET Docket No. 98-153), DA 01-171 (OET Jan. 24, 2001) (Public Notice).

comments in response to the Commission's Notice of Proposed Rule Making in the above-captioned proceeding.[2] Rockwell Collins commends the NTIA for its hard work on determining the potential interference of UWB devices on non-Global Positioning Satellite ("non-GPS") U.S. Government operations and offers the following additional comments for consideration.

DISCUSSION

In its earlier comments,[3] Rockwell Collins noted that UWB device operation below 5.15 GHz would be problematic because of potential harmful radio frequency interference to two aeronautical safety systems. One of those systems, the Microwave Landing System (MLS), is a flight-critical system for aviation precision approach and landing that uses Part 15 restricted bands near 5 GHz. The MLS currently operates on a worldwide basis from 5.03 to 5.091 GHz and the allocation provides for additional frequency channels to 5.15 GHz.[4] MLS is designed to provide radio signal beams for aircraft precision approach navigation especially in low visibility Instrument Meteorological Conditions of Category I[5] through III.[6] As such, MLS requires a very low probability of disruption (less than 10^{-7} per approach).[7] This high continuity performance must be accounted for through the use of techniques such as adequate safety margins if new types of signals are permitted in the MLS frequency band.

MLS was one of the several federal systems analyzed in the NTIA compatibility assessment report.[8] The Electromagnetic Compatibility ("Compatibility") analysis for MLS

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[2] Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems, Notice of Proposed Rule Making, FCC 00-163, slip op. (rel. May 11, 2000).
[3] *See* Comments of Rockwell Collins, ET Docket No. 98-153 (filed September 12, 2000) at 5.
[4] International Civil Aviation Organization, Aeronautical Telecommunications Annex 10 to the Convention on International Civil Aviation, Vol. I, Sect. 3.11, July 1996, ("ICAO Annex 10").
[5] FAA Advisory Circular 120-29, "Criteria for Approving Category I and Category II Landing Minima for FAR 121 Operators (Changes 1 through 3 dated 12/3/74 incorporated)."
[6] FAA Advisory Circular 120-28D, "Criteria for Approval of Category III Weather Minima for Take-off, Landing, and Roll-out."
[7] *See* ICAO Annex 10.
[8] See OSM Report at 4-27 to 4-29.

shows UWB emissions exceed the MLS receiver protection level at horizontal separation distances less than 160 meters for UWB emissions at the proposed –41.3 dBm/MHz average Effective Isotropic Radiated Power (EIRP) limit.[9] Detailed inspection of the MLS analysis reveals the actual minimum total separation distances are somewhat larger to take account of both the vertical and horizontal components of the slant range. For non-dithered UWB sources with a Pulse Repetition Frequency (PRF) greater than 1 MHz, the minimum slant range to the MLS airborne receiver for Compatibility is actually 162.4 meters. The 162.4 meter slant range is a root-sum-square combination of the 160 meter horizontal[10] and 28 meter vertical separations (30m aircraft height minus 2m UWB height). For dithered-PRF UWB sources, the minimum slant range to the MLS airborne receiver for Compatibility is 75.4 meters, a combination of 70 meter horizontal and 28 meter vertical separations.[11] It is also noted that the receiver interference threshold (-134 dBm) used in the analysis is only 4 dB below the receiver maximum permissible interference level (an inadequate safety margin for a Category III system). In addition, the report analysis shows that the UWB (2m height) separation distance for Compatibility with a Fixed Satellite Service (FSS) earth station (3.7-4.2 GHz) is 3000 meters.[12] The analysis also shows a 30 meter high UWB needs a similarly large separation distance for Compatibility with the Terminal Doppler Weather Radar (5.6-5.65 GHz).[13] There is no physical barrier to keep the UWB device at a safe distance away from these operations.

Under current aviation practice, the last portion of a MLS precision approach geometry near the decision height is essentially identical to that for GPS and Instrument Landing System (ILS) approaches (the so-called "ILS Look-Alike" concept). Recent studies by the RTCA have

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[9] Id.
[10] *See* OSM Report at Table 4-34.
[11] Id. at Table 4-35.
[12] Id. at Table 4-38a.

shown that the minimum separation distances for Category I and Category II/III GPS precision approaches are 30.5 meters[14] and 21.3 meters,[15] respectively. These separation distance values allow for aircraft deviations below the nominal flight path and for RFI source placement at the maximum height for approach path obstacles. To permit proper MLS approach operations, UWB emissions must be at or below the value compatible with these same minimum separation distances. Higher UWB emission levels that result in larger separation distances for Compatibility are disruptive to proper MLS operations. Comparison of the NTIA calculated 162.4 meter separation distance for UWB-MLS Compatibility with the 30.5 and 21.3 meter minimum separation distances in the actual Category I and II/III approach scenarios shows the NTIA distance for Compatibiliy exceeds the prescribed minimum separations by between 5.3 and 8 times.

In addition, the report analysis shows that, on a peak power basis, a 2 meter high UWB source with 1 MHz or lower PRF must be separated greater than 3000 meters for Compatibility with a Fixed Satellite Service (FSS) earth station (3.7-4.2 GHz).[16] Distances greater than 10 kilometers are required for Compatibility with a 30 meter high UWB source. The analysis also shows that, independent of PRF or dithering, a 30 meter high UWB source needs a separation distance greater than 6 kilometers for Compatibility with the Terminal Doppler Weather Radar (5.6-5.65 GHz).[17] These large separation distances are significant because there are not necessarily any physical barriers to prevent a Part 15 UWB device from being closer to these victim receivers. Therefore, it is likely these important aviation services would be disrupted.

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[13] Id. at Table 4-48.
[14] RTCA SC-159, "Assessment of Radio Frequency Interference Relevant to the GNSS," Doc. No. RTCA/DO-235, Jan. 27, 1997, RTCA, Inc., Washington, DC at Appendix. A.
[15] RTCA Second Interim Report on UWB RFI (Aviation Segment), pp. 20-22. http://www.rtca.org/comm/reports/pmc-sc-159-uwbreports.htm.
[16] Id. at Table 4-42b.
[17] Id. at Tables 4-49, 4-50.

The NTIA report concludes that UWB device operation under Part 15 "is feasible in portions of the spectrum between about 3.1 and 5.65 GHz at heights of about 2 meters with some operating restrictions."[18] This conclusion does not adequately address the analysis results for the MLS airborne receiver. MLS was noted to be one of the two most sensitive systems in the 3.1-5.65 GHz frequency range and the report recommends further analysis.[19] Rockwell Collins has shown in the preceding discussion that there is serious impact to MLS Category I (minimum separation distance is too large by factor of up to 5.3) and Category II precision approach operations (8 times too large minimum separation) for single UWB emitters. Insufficient margin (4 dB) was incorporated by the NTIA to account for aggregate RFI from multiple UWB transmitters. The aggregate effect from three UWB emitters would exceed the margin and one could reasonably expect several more UWB emitters within a short distance from the MLS receiver. These problems with MLS, together with the results on the FSS earth station (3.7-4.2 GHz) and Terminal Doppler Weather Radar (5.6 – 5.65 GHz), suggest that general UWB operation should indeed be restricted to above 6 GHz.

[18] OSM Report at pg. X.
[19] Id. at 6-3.

CONCLUSION

Rockwell Collins agrees with the NTIA that UWB devices should not be permitted to operate below 3.1 GHz and recommends that UWB operations be restricted to above 6 GHz. Rockwell Collins does not agree with the NTIA that UWB devices are capable of operating safely between 3.1 – 5.65 GHz based upon our discussion above regarding MLS, FSS, and Terminal Doppler Weather Radar systems.

Respectfully submitted,

ROCKWELL COLLINS, INC.

By: _____

Linda C. Sadler
Director
Governmental and Regulatory Affairs
1300 Wilson Blvd
Suite 200
Arlington, VA 22209
703-516-8200
lcsadler@collins.rockwell.com